REMARKS

Claims 1-17 are now presented for examination. Claims 15 and 16 have been cancelled without prejudice or disclaimer of subject matter. Claims 1, 8, 12 and 14 has been amended to define still more clearly what Applicants regards as their invention, in terms which distinguish over the art of record. Claim 17 has been added to assure Applicants of the full measure of protection to which they deem themselves entitled. Claims 1, 8, 12 and 14 are the only independent claims.

Applicant thanks the Examiner for the courtesy extended during the interview of July 8, 2003. In the interview, a draft amendment was presented and discussed and possible changes to the claims were suggested by Applicant's attorney. No agreement was reached on the draft amendment.

Claims 1-14 have been rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent 5,892,573 (Takahashi et al. '573). With regard to the claims as currently amended, this rejection is respectfully traversed.

Independent Claim 1 as currently amended is directed to exposure apparatus in which an illumination optical system illuminates an original on which a pattern is formed by exposure light emitted from a light source. A projection optical system projects the pattern to a photosensitive object. A first photodetector is disposed in a portion that receives light from an optical path between the light source and the portion where the original is placed. The first photodetector is used to monitor the emission light amount from the light source. A processor system changes the proportional coefficient of a target value of the first photodetector output and a voltage applied to the light source according to

the change of transmittance in an optical path from said light source to said first photodetector of at least an optical element.

Independent Claim 8 as currently amended is directed to a method of producing devices using an exposure apparatus. According to the method, an illumination optical system illuminates an original on which a pattern is formed by exposure light from a light source. A projection optical system projects the pattern to a photosensitive object and light is received by a first photodetector from an optical path between the light source and a portion where the original is placed. The first photodetector monitors the light source emission light amount. The proportional coefficient of a target value of the output of the first light photodetector and the voltage applied to the light source are changed according to the change of transmittance in an optical path from said light source to said first photodetector of at least an optical element. The photosensitive object is developed with a projected pattern to produce a circuit device. The illumination step is performed on the basis of the changed proportional coefficient for the first photodetector.

Independent Claim 12 as currently amended is directed to a method of exposing an original and projection a pattern formed on the original onto a photosensitive object. According to the method, the original is illuminated with an illumination optical system by exposure light from a light source and the pattern of the original is projected onto the photosensitive object with a projection optical system. Light is received by a first photodetector from the optical path between the light source and a portion where the original is placed. The emission light amount from the light source is monitored by the first photodetector. The proportional coefficient of a target value of the first photodetector output and the voltage applied to the light source are changed according to the change of

transmittance in an optical path from said light source to said first photodetector of at least an optical element. The illumination is performed using the changed proportional coefficient for the first photodetector.

In Applicants' view, Takahashi et al. '573 discloses an exposure apparatus having an illumination optical system. A first light receiving system receives a portion of exposure light from the illumination optical system. A movable reticle stage has a transmitting portion that transmits exposure light and a second light receiving system receives the exposure light transmitted through the transmitting portion. The exposure apparatus is able to correct the sensitivity of the first light receiving system without unloading a reticle.

In accordance with the invention of pending Claims 1, 8 and 12, a first photodetector disposed to receive light from an optical path between a light source and an original in an illumination optical system monitors the light emission amount from the light source. A processor system operates to change a proportional coefficient of a target value of the first detector output and the voltage applied to the light source according to a transmittance change in an optical path from the light source to the first photodetector of at least an optical element. In this way, the light quantity which should be emitted from the light source for proper exposure of a photosensitive object is maintained.

Takahashi et al. '573 may disclose an exposure apparatus having an illumination optical system and a projection optical system in which a photodetector 12 receives a portion of light from a condenser lens 4 in the illumination optical system redirected by a half mirror 5. As disclosed at lines 44-48 of column 4 of Takahashi et al. '573, "A portion of illumination light from the condenser lens 4 is divided by a half mirror 5, and the detector 12 monitors the thus divided light to thereby indirectly monitor the exposure

amount to be applied to the wafer W." and further disclosed at lines 48-52 of column 9 "If, however, the transmissivity of optical components varies due to irradiation with exposure light from the light source, it results in a difference between the actual light quantity on the wafer W and the light quantity as predicted from the output signal S1 of the first detector 12." Accordingly, the light quantity at the wafer W is predicted from the output signal S1 of the first detector and sensitivity correction is only performed in relation to the light quantity on the wafer as predicted by the light quantity of the first detector.

In Takahashi et al. '573, it is disclosed with respect to sensitivity correction at lines 7-18 of column 10 that if the transmissivity of the illumination optical system or the projection optical system has varied with time:

> " Thus, the calculating means 102 performs sensitivity correction calculation on the basis of the output signals S1 and S2. If the transmissivity of the portion of the illumination optical system 100 at the half mirror 5 and following it is T_I, the transmissivity of the projection optical system is T_p and the reflectivity of the reference reflection surface 15 (of predetermined reflectivity) is R, then the output signal S2 of the second detector 13 is given by:
>
> $S2 \alpha T_I^2 x T_P^2 x R$ (1)
>
> and is proportional to the square of the transmissivity of the illumination optical system 100 and the projection optical system 10."

As a result, Takahashi et al. '573 only considers the transmissivity of the illumination optical system from the half-mirror 5 (the point at which the first detector is positioned) T_I and following it and the transmissivity of the projection optical system T_P as shown in equations 1 through 9 in relation to the signal S2 at the wafer 13 and the ratio of

the light output of the wafer detector 13 to the light amount of the first detector 12 (fS2/gS1). Accordingly, it is not seen that any change of transmittance in an optical path from the light source to the first photodetector of at least an optical element could affect Takahashi et al. '573's calculation and control based on the relationship between the output signal S1 and the light quantity amount on the wafer W.

In contrast to Takahashi et al. '573's consideration of the transmissivity T_I from the half-mirror 5 and the transmissivity T_P of the projection optical system, the present invention at least at lines 8-15 of page 18 in the specification, discloses "If the transmittance of the illumination optical system changes, then a coefficient h' based on the transmittance change from the light source 1 to the light amount detector 12 is determined, and the voltage to be informed to the light source 1 is set by V = h' x s, where h' is calculated by h' = h x β. Reference character β will be the value representing the transmittance change."

Takahashi et al. '573 is therefore directed solely to using the light quantity predicted from the output signal S1 of first detector 12 to determine the actual light quantity on the wafer W. Differences between the actual light quantity on wafer W and the light quantity predicted by the S1 output of the first detector 12 are caused only by changes in transmittance of the optical elements between the first detector 12 and the wafer W and adjustments in the sensitivity of first detector 12 in predicting the light quantity amount on the wafer W are affected only by the optical elements between the first detector 12 and the wafer W. Any change of transmittance in an optical path from the light source to the first photodetector of at least an optical element, however, does not affect the relationship between the output signal S1 and the light quantity amount on the wafer W. Accordingly, it

is not seen that Takahashi et al. '573 in any manner teaches or suggests the feature of Claims 1, 8 and 12 of changing a proportional coefficient of a target value of an output of the first photodetector and a voltage applied to the light source, in accordance with the change of transmittance in an optical path from the light source to the first photodetector of at least an optical element. It is therefore believed that pending Claims 1, 8 and 12 are completely distinguished from Takahashi et al. '573 and are allowable.

Independent Claim 14 as currently amended is directed to exposure apparatus in which an illumination optical system illuminates an original on which a pattern is formed by exposure light from a pulsed laser light source. A projection optical system projects the pattern to a photosensitive object. A photocell is disposed in a portion that receives light from an optical path between the light source and a portion where the original is placed. The photodetector is used to monitor the emission light amount from the light source. A processing system performs sensitivity correction of the photocell relative to information of the pulse energy of the light source, the oscillation frequency of the light source, the irradiating time of pulsed laser light to the illumination optical system at the oscillation frequency and the time that the pulsed laser light is not irradiated to the illumination optical system for longer than a pulse period of the oscillation frequency.

According to the invention of Claim 14 as currently amended, a photodetector receives light from an optical path between the light source and a portion where an original is placed to monitor the emission light of the light source. A processing system performs sensitivity correction of the photodetector in relation to light source pulse energy information, the light source oscillation frequency, the time of pulsed laser light irradiation of the illumination optical system at the oscillation frequency and the time the pulsed laser

light is not irradiated to the illumination optical system and is longer than the oscillation frequency pulse period. Advantageously, the sensitivity correction can be performed during exposure.

The features of Claim 14 of sensitivity correction related to the time of pulsed laser light irradiation of the illumination optical system at the oscillation frequency and the time the pulsed laser light is not irradiated to the illumination optical system and is longer than the oscillation frequency pulse period are shown in Fig. 5 and are disclosed at lines 15-18 of page 21 in the specification. No new matter is believed to have been added.

As discussed with respect to Claims 1, 8 and 12, Takahashi et al. '573 only discloses a processing system that performs sensitivity correction of a first light quantity detector 12 disposed between a light source and where an original is placed using the output signal of the first light quantity detector 12 and the output signal from a second light quantity detector placed at the wafer position. Further, Takahashi et al. '573 is devoid of any suggestion of processing sensitivity correction in relation to the time of pulsed laser light irradiation of the illumination optical system at the oscillation frequency and the time the pulsed laser light is not irradiated to the illumination optical system and is longer than the oscillation frequency pulse period. In view of the requirement of the second light quantity detector at the wafer position where the exposure light is irradiated, it is not seen that Takahashi et al. '573 which requires first and second light quantity detectors at different locations for sensitivity correction and which is devoid of any suggestion of determining the time of pulsed laser light irradiation of the illumination optical system at the oscillation frequency and the time the pulsed laser light is not irradiated to the illumination optical system and is longer than the oscillation frequency pulse period could possibly teach of

suggest the features of Claim 14. It is therefore believed that Claim 14 as currently amended is completely distinguished from Takahashi et al. '573 and is allowable.

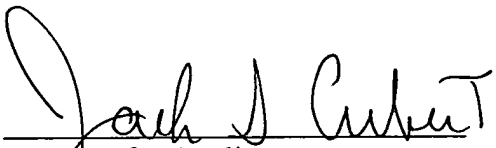
A review of the other art of record has failed to reveal anything which, in Applicants' opinion, would remedy the deficiencies of the art discussed above, as references against the independent claims herein. Those claims are therefore believed patentable over the art of record.

The other claims in this application are each dependent from one or another of the independent claims discussed above and are therefore believed patentable for the same reasons. Since each dependent claim is also deemed to define an additional aspect of the invention, however, the individual consideration and reconsideration, as the case may be, of the patentability of each on its own merits is respectfully requested.

In view of the foregoing amendments and remarks, Applicants respectfully request favorable reconsideration and early passage to issue of the present application.

Applicants' attorney, Steven E. Warner, may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our below listed address.

Respectfully submitted,



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